Collaborative Research Projects in Support of FNMOC Operational Mission

Carlyle H. Wash
Department of Meteorology
Naval Postgraduate School
589 Dyer Rd., Room 254
Monterey, CA 93943-5114
Phone: (831) 656-2517 fax: (831) 656-3061 e-mail: wash@nps.navy.mil
Award #: N0001498WR30015

LONG-TERM GOAL

Support applied research at FNMOC with NPS collaborative Master Thesis projects.

OBJECTIVES

This report describes the two collaborative theses in the Department of Meteorology supported by this project last year. They include testing the new FNMOC product, METCAST by LCDR Brian Conan and improved visualization of FNMOC products using Joint METOC Viewer (JMV) by LT Keith Barto.

APPROACH

This "umbrella" effort funds collaborative research projects by NPS Meteorology Department faculty and students and by FNMOC personnel. The specific projects supported under this proposal were developed by mutual agreement between a NPS thesis student, a NPS-Meteorology faculty member (Thesis Advisor) and a FNMOC employee with whom the NPS personnel will collaborate. Projects are approved by the Chairman of the NPS Meteorology Department and by the FNMOC Technical Director. This report will describe the NPS theses completed or in progress during FY1999 under this project. All of the theses completed under this effort during FY97, FY98 and FY99 are listed in the references.

WORK COMPLETED

Two collaborative research projects have been conducted with support received in FY99, one is complete and one is in progress. In the completed thesis project, LCDR Brian Connon worked with Mr. Dave Huff at FNMOC and Professor Ken Davidson at NPS to create and test a conceptual model for METOC sensor and product display and communications aboard ships without an embarked METOC division, i.e. cruisers, destroyers, frigates, etc.

What motivated LCDR Connon was that meteorological and oceanographic (METOC) data acquisition and product distribution for surface combatants has remained unchanged for a number of years. As naval warfare has shifted its focus from the open ocean into littoral regions (where temporal and spatial changes in atmospheric and oceanographic characteristics can significantly affect the tactical ability of the ship's weapon systems), requirements for timely and accurate environmental information have increased. Operational METOC commands have made significant strides towards meeting these

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 1999		**00-00-1999 to 00-00-1999**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Collaborative Research Projects in Support of FNMOC Operational Mission	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Postgraduate School,Department of Meteorology,589 Dyer Rd., Room 254,Monterey,CA,93943**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**3**	

requirements with advanced coupled mesoscale forecast models, improved tactical decision aids, and tailored environmental products. However, use of this improved support has not been easily attainable by surface combatants because of limited access to communications resources.

In the first thesis study, a prototype Moriah system is coupled with ADNS and Fleet Numerical Meteorology and Oceanography Center (FNMOC) METCAST distribution software aboard USS Juneau (LPD-10). This was accomplished during USS Juneau's participation in Littoral Lightning, a segment of Fleet Battle Experiment Echo, in the Southern California (SOCAL) operating area in April 1999.

The addition of Moriah, METCAST, and ADNS to surface combatants offers an opportunity for the U. S. Navy to reach a higher level of METOC support and data collection. As Moriah and other in-situ and remote sensors record and submit accurate observations, METCAST can provide the ship with enhanced METOC products from a multitude of sites. This integration is defined as Battlespace METOC Data Acquisition, Assimilation, and Application (BMDA3) by the Oceanographer of the Navy (1996) as a common tactical picture in which environmental conditions are available to warfare commanders for visualization, and exploitation, of the battlespace. METOC data collection, fusion, and dissemination, combined with METOC community expertise and Network Centric (NC) warfare systems, is key to accomplishing this goal.

In the thesis in progress, LT Keith Barto is interested in the improvement of FNMOC METOC analysis and forecast visualizations. He is motivated by the following problems: Current Navy METOC weather visualization tools do not allow forecasters and scientists to analyze and co-display environmental data over realistic/accurate topographic and bathymetric backgrounds. Furthermore, forecasters are forced to interpolate model output and perform analysis with no display of terrain information. This can lead to reduced final product accuracy; especially in predicting and interpreting model low level winds. Resultant value of graphics-based products is reduced for end users. Products are less visually useful and appealing. Fleet METOC assets in general are unable to utilize and visualize the terrain data or surface color or land type indexes within the common domain of universal display tools like Joint METOC Viewer which they have available and are trained on.

RESULTS

Connon’s thesis showed that the exchange of METOC information to and from surface combatants can be improved by deploying advanced environmental sensor suites, applying new data distribution technologies, and exploiting U. S. Navy communication systems. METCAST was shown to disseminate timely, relevant METOC information via ADNS to a surface combatant at sea. A prototype Moriah/METCAST system was shown, by an actual at sea test conducted by LCDR Connon, to be capable of transmitting high frequency, continuously acquired observations via ADNS to a shore METOC data collection point. It is apparent Moriah, METCAST, and ADNS offer a chance for METOC information to truly become a force multiplier.

LT Barto has reviewed all available terrain datasets such as DTED level 0 and 1, GTOPO30, ETOPO5 and World Vector Shoreline 1999. He is currently using a state-of-the-art Geographic Information System called ARCVIEW to produce high resolution terrain dataset that can be used by Joint METOC Viewer. Through LT Barto’s work, one new version of JMV with enhanced terrain information has already been released by FNMOC. Thesis Advisors are Professor Carlyle Wash, Naval Postgraduate School and Mr. Ralph Loveless, Fleet Numerical Meteorology and Oceanography Center, Monterey,

CA. Contributors to the work include Larry Miller (Images/Programming), Bruce Mendenhall (Database/Programming) and Robert Creasy (Technical Advisor).

IMPACT/APPLICATIONS

Both of these thesis efforts have assisted FNMOC and CNMOC in testing and developing new software to improve the use of FNMOC products. LCDR Connon provided the first at-sea test of METCAST and LT Barto is providing new terrain display capabilities to JMV.

PUBLICATIONS

Connon, B. D. (1999) Surface combatant integration of METOC data acquistion and product distribution systems within the IT-21 communications architecture. M. S. Thesis, Naval Postgraduate School, June 1999.

Barto, K. P. (2000) Improvements to FNMOC visualization tools for terrain and other parameters. M. S. Thesis, Naval Postgraduate School, In progress- June 2000 completion.

Bommarito, B., (1998) A principle component Approach for FNMOC Probability of Precipitation Forecast. M. S. Thesis, Naval Postgraduate School, September 1998.

Marsteller, G. F. (1998) Comparison of the NOGAPS Cloud Analyses and Forecasts with the Air Force Real-time Nephanalysis Cloud Model. M. S. Thesis, Naval Postgraduate School, June 1998.

Whalen, J. D., (1998), Comparison of Evaporation Duct Height Measurement Methods and their Impact on Radar Propagation Estimates. M. S. Thesis, Naval Postgraduate School, June 1998.